AzMERIT | Arizona's Statewide Achievement Assessment for English Language Arts and Mathematics

Mathematics Item Specifications

GRADE 8

Arizona Department of Education with American Institutes for Research - 2018

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Introduction

The Arizona Statewide Achievement Assessment for English Language Arts and Mathematics (AzMERIT) is Arizona's statewide achievement test. AzMERIT assesses the Arizona English Language Arts Standards and Arizona Mathematics Standards adopted by the Arizona State Board of Education in December 2016. AzMERIT will inform students, teachers, and parents about preparedness for college and careers upon graduating from high school. AzMERIT tests are computer-based, meaning that they can better assess students' critical thinking skills and provide them with opportunities to demonstrate a deeper understanding of the materials. Computer-based testing also allows for the use of a variety of innovative items types.

During the item-development process, all AzMERIT items are written in accordance with the Item Specifications and are reviewed and approved by a committee of Arizona educators to confirm alignment and appropriateness for inclusion in the test. AzMERIT items are generally representative of Arizona's geographic regions and culturally diverse population. Items are reviewed for the following kinds of bias: gender, racial, ethnic, linguistic, religious, geographic, and socioeconomic. Item reviews also include consideration of issues related to individuals with disabilities. Arizona community members also have an opportunity to review items for issues of potential concern to members of the community at large. Reviewers are asked to consider the variety of cultural, regional, philosophical, political, and religious backgrounds throughout Arizona, and then to determine whether the subject matter will be acceptable to Arizona students, families, and other members of Arizona communities.

This *AzMERIT Item Specifications* is a resource document that defines the content and format of the test and test items for item writers and reviewers. Each *Item Specifications* document indicates the alignment of items with the Arizona Mathematics Standards. It also serves to provide all stakeholders with information about the scope and function of assessment items. This document can also serve to assist educators to understand how assessment items are developed in alignment with the standards for English language arts and math. These item specifications for AzMERIT are intended to provide information regarding standards, item formats and response types. The descriptions of math blueprints and depth of knowledge in this document are meant to provide an overview of the test. Item specifications are meant for the purposes of assessment, not instruction. They are not intended to be tools for instruction or the basis for curricula. AzMERIT has a test blueprint that was developed by Arizona and is different from any other state or consortium test blueprint.

For the math portion of AzMERIT, all of the test questions are aligned to the mathematic content standards for these subject areas. Any item specifications that are absent for standards listed in this document may be under development. This document does not endorse the exclusion of the instruction of any grade-level content standards. The test will ask questions that check a student's conceptual understanding of math as well as their procedural skills. These items have been written to be free from bias and sensitivity, and widely vary in their degree of difficulty.

Item Development Process

AzMERIT items go through a rigorous review before they are operational. When an item is "operational" it means it is used to determine a student's score on the assessment. This is a description of the process every item must go through before it is operational on AzMERIT.

Sample tests are available online for the math portion of AzMERIT. For more information view the Guide to the Sample Tests at www.azmeritportal.org.

Test Construction Guidelines

The construction of the AzMERIT assessment is guided by the depth and rigor of the Arizona College and Career Ready Standards. Items are created to address key components of the standards and assess a range of important skills. The AzMERIT Blueprint provides an overview of the distribution of items on the AzMERIT according to the standards. The standards for Math Practices are embedded within all AzMERIT items. Further, the AzMERIT blueprint outlines the Depth of Knowledge distribution of items.

Blueprint

Grade 8 AzMERIT Blueprint 2016 Standards		
Reporting Category	**Min.**	**Max.**
Functions	21%	25%
Expressions & Equations	29%	33%
Geometry	17%	21%
Statistics & Probability & the Number System	19%	27%
Statistics and Probability	*4%*	*8%*
Number System	*15%*	*19%*

Depth of Knowledge (DOK)

DOK refers to the level of rigor or sophistication of the task in a given item, designed to reflect the complexity of the Arizona Mathematics Standards. Items at DOK level 1 focus on the recall of information, such as definitions, terms, and simple procedures. Items at DOK 2 require students to make decisions, solve problems, or recognize patterns; in general, they require a greater degree of engagement and cognitive processing than items at DOK 1. Items at DOK 3 feature higher-order cognitive tasks that assess students' capacities to approach abstract or complex problems.

Percentage of Points by Depth of Knowledge (DOK) Level			
Grade 8	DOK Level 1	DOK Level 2	DOK Level 3
	10% - 20%	60% - 70%	12% - 30%

For more information on DOK go to www.azed.gov/AzMERIT.

Calculators

Arizona Desmos Scientific Calculator is permitted for the paper-based and computer-based assessment for Grade 8 Math.

Item Formats

The AzMERIT Assessments are composed of item formats that include traditional multiple-choice response items and technology-enhanced response items (TEI). TEIs are computer-delivered response items that require students to interact with test content to select, construct, and/or support their responses. TEIs are better able to assess a deeper level of understanding.

Currently, there are nine types of TEIs that may appear on the Math computer based assessment for AzMERIT:

- Editing Tasks (ET)
- Editing Task Choice (ETC)
- Equation Editor (EQ)
- Graphic Response Item Display (GRID)
- Hot Text (HT)
    - Selectable Hot Text
    - Drag-and-Drop Hot Text
- Matching Item (MI)
- Multi-Select (MS)
- Open Response
- Table Item (TI)

For paper-based assessments (including those for students with an IEP or 504 plan that specifies a paper-based accommodation), TEIs will be modified so that they can be scanned and scored electronically or hand-scored.

See the table below for a description of each TEI. In addition, for examples of each response item format described, see the AzMERIT Training Tests at www.azmeritportal.org.

Item Format	Description
Editing Task (ET)	The student clicks on a highlighted word or phrase that may be incorrect, which reveals a text box. The directions in the text box direct the student to replace the highlighted word or phrase with the correct word or phrase. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.
Editing Task Choice (ETC)	The student clicks a highlighted word or phrase, which reveals a drop-down menu containing options for correcting an error as well as the highlighted word or phrase as it is shown in the sentence to indicate that no correction is needed. The student then selects the correct word or phrase from the drop-down menu. For paper-based assessments, the item is modified so that it can be scanned and scored electronically. The student fills in a circle to indicate the correct word or phrase.

Item Format	Description
Equation Editor (EQ)	The student is presented with a toolbar that includes a variety of mathematical symbols that can be used to create a response. Responses may be in the form of a number, variable, expression, or equation, as appropriate to the test item. For paper-based assessments, this item type may be replaced with a modified version of the item that can be scanned and scored electronically or replaced with another item type that assesses the same standard and can be scanned and scored electronically.
Graphic Response Item Display (GRID)	The student selects numbers, words, phrases, or images and uses the drag-and-drop feature to place them into a graphic. This item type may also require the student to use the point, line, or arrow tools to create a response on a graph. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.
Hot Text (HT)	**Selectable Hot Text -** Excerpted sentences from the text are presented in this item type. When the student hovers over certain words, phrases, or sentences, the options highlight. This indicates that the text is selectable (“hot”). The student can then click on an option to select it. For paper- based assessments, a “selectable” hot text item is modified so that it can be scanned and scored electronically. In this version, the student fills in a circle to indicate a selection.
	Drag-and-Drop Hot Text - Certain numbers, words, phrases, or sentences may be designated “draggable” in this item type. When the student hovers over these areas, the text highlights. The student can then click on the option, hold down the mouse button, and drag it to a graphic or other format. For paper-based assessments, drag- and-drop hot text items will be replaced with another item type that assesses the same standard and can be scanned and scored electronically.
Matching Item (MI)	The student checks a box to indicate if information from a column header matches information from a row. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.
Multi-Select (MS)	The student is directed to select all of the correct answers from among a number of options. These items are different from multiple-choice items, which allow the student to select only one correct answer. These items appear in the online and paper-based assessments.
Open Response	The student uses the keyboard to enter a response into a text field. These items can usually be answered in a sentence or two. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.

Item Format	Description
Table Item (TI)	The student types numeric values into a given table. The student may complete the entire table or portions of the table depending on what is being asked. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.

Arizona Math Standards Grade 8

The Number System (NS)		
8.NS.A Understand that there are irrational numbers, and approximate them using rational numbers.	**8.NS.A.1**	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion. Know that numbers whose decimal expansions do not terminate in zeros or in a repeating sequence of fixed digits are called irrational.
	8.NS.A.2	Use rational approximations of irrational numbers to compare the size of irrational numbers. Locate them approximately on a number line diagram, and estimate their values.
	8.NS.A.3	Understand that given any two distinct **rational** numbers, $a < b$, there exist a rational number c and an irrational number d such that $a < c < b$ and $a < d < b$. Given any two distinct **irrational** numbers, $a < b$, there exist a rational number c and an irrational number d such that $a < c < b$ and $a < d < b$.
Expressions and Equations (EE)		
8.EE.A Work with radicals and integer exponents.	**8.EE.A.1**	Understand and apply the properties of integer exponents to generate equivalent numerical expressions.
	8.EE.A.2	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Know that $\sqrt{2}$ is irrational. a. Evaluate square roots of perfect squares less than or equal to 225. b. Evaluate cube roots of perfect cubes less than or equal to 1000.
	8.EE.A.3	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and express how many times larger or smaller one is than the other.
	8.EE.A.4	Perform operations with numbers expressed in scientific notation including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities.
8.EE.B Understand the connections between proportional relationships, lines, and linear equations.	**8.EE.B.5**	Graph proportional relationships interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*
	8.EE.B.6	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane. Derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at $(0, b)$.

8.EE.C Analyze and solve linear equations, inequalities, and pairs of simultaneous linear equations.	**8.EE.C.7**	Fluently solve linear equations and inequalities in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solution. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers). b. Solve linear equations and inequalities with rational number coefficients, including solutions that require expanding expressions using the distributive property and collecting like terms.
	8.EE.C.8	Analyze and solve pairs of simultaneous linear equations. a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations including cases of no solution and infinite number of solutions. Solve simple cases by inspection. c. Solve mathematical problems and problems in real-world context leading to two linear equations in two variables.
Functions (F)		
8.F.A Define, evaluate, and compare functions.	**8.F.A.1**	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required in Grade 8.)
	8.F.A.2	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*
	8.F.A.3	Interpret the equation $y = mx + b$ as defining a linear function whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length in not linear because its graph contains the points (1,1), (2,4), and (3,9) which are not on a straight line.*
8.F.B Use functions to model relationships between quantities.	**8.F.B.4**	Given a description of a situation, generate a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or a graph. Track how the values of the two quantities change together. Interpret the rate of change and initial value of a linear function in terms of the situation it models, its graph, or its table of values.
	8.F.B.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Geometry (G)		
8.G.A **Understand congruence and similarity.**	**8.G.A.1**	Verify experimentally the properties of rotations, reflections, and translations. Properties include: lines are taken to lines, line segments are taken to line segments of the same length, angles are taken to angles of the same measure, parallel lines are taken to parallel lines.
	8.G.A.2	Understand that a two-dimensional figure is congruent to another if one can be obtained from the other by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that demonstrates congruence.
	8.G.A.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
	8.G.A.4	Understand that a two-dimensional figure is similar to another if, and only if, one can be obtained from the other by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that demonstrates similarity.
	8.G.A.5	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*
8.G.B **Understand and apply the Pythagorean Theorem.**	**8.G.B.6**	Understand the Pythagorean Theorem and its converse.
	8.G.B.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world context and mathematical problems in two and three dimensions.
	8.G.B.8	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
8.G.C **Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.**	**8.G.C.9**	Understand and use formulas for volumes of cones, cylinders and spheres and use them to solve real-world context and mathematical problems.

Statistics and Probability (SP)		
8.SP.A **Investigate patterns of association in bivariate data.**	**8.SP.A.1**	Construct and interpret scatter plots for bivariate measurement data to investigate and describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
	8.SP.A.2	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
	8.SP.A.3	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
	8.SP.A.4	Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.
8.SP.B **Investigate chance processes and develop, use, and evaluate probability models.**	**8.SP.B.5**	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. a. Understand that the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. b. Represent sample spaces for compound events using organized lists, tables, tree diagrams and other methods. Identify the outcomes in the sample space which compose the event. c. Design and use a simulation to generate frequencies for compound events.

Grade 8 Math Item Specifications

Expressions and Equations

8.EE.A.1

Content Standards	Understand and apply the properties of integer exponents to generate equivalent numerical expressions.
Explanations	Work with radicals and integer exponents.
Content Limits	Integer exponents Rational numbers for bases
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify equivalent numerical expressions using the properties of exponents.	• Equation Response • Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to complete an equivalent expression using the properties of exponents.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Apply the properties of integer exponents to identify equivalent numerical expressions.	Apply the properties of integer exponents to generate equivalent numerical expressions.
Proficient	**Highly Proficient**
Understand and apply the properties of integer exponents to generate equivalent numerical expressions.	Understand and apply the properties of integer exponents to generate and interpret equivalent numerical expressions.

8.EE.A.2, 8.EE.A.2a, 8.EE.A.2b

Content Standards	**8.EE.A.2** Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Know that √2 is irrational. **8.EE.A.2a** Evaluate square roots of perfect squares less than or equal to 225. **8.EE.A.2b** Evaluate cube roots of perfect cubes less than or equal to 1000.
Explanations	Work with radicals and integer exponents.
Content Limits	Square roots and cube roots Rational and irrational numbers When evaluating roots, the base of a square root should be 100 or less and the base for a cube root should be 125 or less.
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify a square or cube root as the solution to a quadratic or cubic equation.	• Equation Response • Multiple Choice Response
Students will be required to find the value of a square or cube root.	
Students will be required to solve simple square or cube root equations.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Know that √2 is irrational. a. Identify square roots of perfect squares less than or equal to 100. b. Identify cube roots of perfect cubes less than or equal to 500.	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Know that √2 is irrational. a. Identify square roots of perfect squares less than or equal to 225. b. Identify cube roots of perfect cubes less than or equal to 1000.
Proficient	**Highly Proficient**
Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Know that √2 is irrational. a. Evaluate square roots of perfect squares less than or equal to 225. b. Evaluate cube roots of perfect cubes less than or equal to 1000.	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Know that √2 is irrational. a. Evaluate square roots less than or equal to 225. b. Evaluate cube roots less than or equal to 1000.

8.EE.A.3

Content Standards	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and express how many times larger or smaller one is than the other.
Explanations	Work with radicals and integer exponents.
Content Limits	None
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to convert between standard form and scientific notation.	• Equation Response • Multiple Choice Response
Students will be required to compare the magnitudes of different quantities given in scientific notation.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities.	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities.
Proficient	**Highly Proficient**
Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and express how many times larger or smaller one is than the other.	Use numbers expressed in the form of a single digit times an integer power of 10 to interpret very large or very small quantities, and express how many times larger or smaller one is than the other.

8.EE.A.4

Content Standards	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities.
Explanations	Students can convert decimal forms to scientific notation and apply rules of exponents to simplify expressions. In working with calculators or spreadsheets, it is important that students recognize scientific notation. Students should recognize that the output of 2.45E+23 is 2.45 x 1023 and 3.5E-4 is 3.5 x 10-4. Students enter scientific notation using E or EE (scientific notation), * (multiplication), and ^ (exponent) symbols.
Content Limits	For TD1, to distinguish from 8.EE.3, do not use single-digit leading terms
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to convert between standard form and scientific notation.	• Equation Response • Multiple Choice Response • Matching Item
Students will be required to perform operations with numbers expressed in scientific notation.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Perform operations with numbers expressed in scientific notation.	Perform operations with numbers expressed in scientific notation including problems where both decimal and scientific notation are used. Use scientific notation for measurements of very large or very small quantities.
Proficient	**Highly Proficient**
Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities.	Perform operations with numbers expressed in scientific notation including problems where both decimal and scientific notation are used. Use scientific notation to interpret for measurements of very large or very small quantities.

8.EE.B.5

Content Standards	Graph proportional relationships interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*
Explanations	Using graphs of experiences that are familiar to students increases accessibility and supports understanding and interpretation of proportional relationship. Students are expected to both sketch and interpret graphs.
Content Limits	Rational numbers y-intercept is zero
Context	Context is required.

Sample Task Demands	Common Item Formats
Students will be required to calculate unit rate given a graph of a proportional relationship.	• Graphic Response • Multiple Choice Response • Multi-Select Response • Table Response
Students will be required to graph proportional relationships, including comparisons to other proportional relationships.	
Students will be required to compare two proportional relationships represented in two different ways.	
Students will be required to create a proportional relationship based on a comparison with another proportional relationship in a different representation.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Graph proportional relationships.	Graph proportional relationships interpreting the unit rate as the slope of the graph. Compare two different proportional relationships.
Proficient	**Highly Proficient**
Graph proportional relationships interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to	Graph proportional relationships interpreting the unit rate as the slope of the graph. Compare and explain two different proportional relationships represented in different ways.

8.EE.B.6

Content Standards	Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane. Derive the equation *y* = *mx* for a line through the origin and the equation *y* = *mx* + *b* for a line intercepting the vertical axis at (0, *b*).
Explanations	Understand the connections between proportional relationships, lines, and linear equations.
Content Limits	None
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to given two points on a line, determine other points on the line.	• Equation Response • Graphic Response • Multiple Choice Response
Students will be required to given three points on a line described abstractly, determine a parameter for a fourth point on the line.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Use similar triangles to identify that the slope is the same between any two distinct points on a non-vertical line in the coordinate plane.	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane. Use the equation *y* = *mx* for a line through the origin and the equation *y* = *mx* + *b* for a line intercepting the vertical axis at (0, *b*).
Proficient	**Highly Proficient**
Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane. Derive the equation *y* = *mx* for a line through the origin and the equation *y* = *mx* + *b* for a line intercepting the vertical axis at (0, *b*).	Use similar triangles to prove why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane. Derive the equation *y* = *mx* for a line through the origin and the equation *y* = *mx* + *b* for a line intercepting the vertical axis at (0, *b*).

8.EE.C.7, 8.EE.C.7a, 8.EE.C.7b

Content Standards	**8.EE.C.7** Fluently solve linear equations and inequalities in one variable. **8.EE.C.7a** Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solution. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers). **8.EE.C.7b** Solve linear equations and inequalities with rational number coefficients, including solutions that require expanding expressions using the distributive property and collecting like terms.
Explanations	As students transform linear equations in one variable into simpler forms, they discover the equations can have one solution, infinitely many solutions, or no solutions. When the equation has one solution, the variable has one value that makes the equation true as in $12 - 4y = 16$. The only value for y that makes this equation true is -1. When the equation has infinitely many solutions, the equation is true for all real numbers as in $7x + 14 = 7(x+2)$. As this equation is simplified, the variable terms cancel leaving $14 = 14$ or $0 = 0$. Since the expressions are equivalent, the value for the two sides of the equation will be the same regardless which real number is used for the substitution. When an equation has no solutions it is also called an inconsistent equation. This is the case when the two expressions are not equivalent as in $5x - 2 = 5(x+1)$. When simplifying this equation, students will find that the solution appears to be two numbers that are not equal or $-2 = 1$. In this case, regardless which real number is used for the substitution, the equation is not true and therefore has no solution.
Content Limits	Rational Numbers
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to determine the number of solutions of an equation where no simplification is required. (a)	• Equation Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to determine the number of solutions of an equation where simplification is required.	
Students will be required to find the solution of an equation. (b)	
Students will be required to construct an equation given parameters including the solution or number of solutions. (a)	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Fluently solve linear equations and inequalities in one variable. a. Identify linear equations in one variable with one solution, infinitely many solutions, or no solution. b. Identify the solution to linear equations and inequalities with rational number coefficients.	Fluently solve linear equations and inequalities in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solution. b. Solve linear equations and inequalities with rational number coefficients.

Proficient	Highly Proficient
Fluently solve linear equations and inequalities in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solution. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers). b. Solve linear equations and inequalities with rational number coefficients, including solutions that require expanding expressions using the distributive property and collecting like terms.	Fluently solve linear equations and inequalities in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solution. Explain which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers). b. Explain how to solve linear equations and inequalities with rational number coefficients, including solutions that require expanding expressions using the distributive property and collecting like terms.

8.EE.C.8, 8.EE.C.8a, 8.EE.C.8b, 8.EE.C.8c

Content Standards	**8.EE.C.8** Analyze and solve pairs of simultaneous linear equations. **8.EE.C.8a** Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. **8.EE.C.8b** Solve systems of two linear equations in two variables algebraically and estimate solutions by graphing the equations including cases of no solution and infinite number of solutions. Solve simple cases by inspection. **8.EE.C.8c** Solve mathematical problems and problems in real-world context leading to two linear equations in two variables.
Explanations	Systems of linear equations can also have one solution, infinitely many solutions or no solutions. Students will discover these cases as they graph systems of linear equations and solve them algebraically. A system of linear equations whose graphs meet at one point (intersecting lines) has only one solution, the ordered pair representing the point of intersection. A system of linear equations whose graphs do not meet (parallel lines) has no solutions and the slopes of these lines are the same. A system of linear equations whose graphs are coincident (the same line) has infinitely many solutions, the set of ordered pairs representing all the points on the line. By making connections between algebraic and graphical solutions and the context of the system of linear equations, students are able to make sense of their solutions. Students need opportunities to work with equations and context that include whole number and/or decimals/fractions.
Content Limits	Rational Numbers (8a) Should involve a graph
Context	Context is subject to task demand.

Sample Task Demands	Common Item Formats
Students will be required to identify the integer solution of a system from a graph. (a) Context is not allowed.	• Equation Response • Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to identify the number of solutions of a system by inspection given the two equations. (b) Context is not allowed.	
Students will be required to solve a system of two equations. (b) Context is not allowed.	
Students will be required to graph a system of equations and select an interval in which the x-or y-value of the solution lies. (b) Context is not allowed.	
Students will be required to solve a problem that can be modeled with a system of equations. (c) Context is required.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Analyze and solve pairs of simultaneous linear equations. a. Identify the point of intersection for graphs of two linear equations in two variables. b. Identify solutions to simple systems of equations by inspection. c. Solve mathematical problems using two linear equations in two variables.	Analyze and solve pairs of simultaneous linear equations. a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs. b. Estimate solutions to systems of two linear equations in two variables by graphing the equations, including cases of no solution and infinite number of solutions. Solve simple cases by inspection. c. Solve mathematical problems and problems in real-world context using two linear equations in two variables.
Proficient	**Highly Proficient**
Analyze and solve pairs of simultaneous linear equations. a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations, including cases of no solution and infinite number of solutions. Solve simple cases by inspection. c. Solve mathematical problems and problems in real-world contexts leading to two linear equations in two variables.	Analyze and solve pairs of simultaneous linear equations. a. Explain that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs because points of intersection satisfy both equations simultaneously. b. Solve systems of two linear equations in two variables algebraically, and solve solutions by graphing the equations including cases of no solution and infinite number of solutions. Solve simple cases by inspection. c. Solve mathematical problems and problems in real-world context by creating two linear equations in two variables.

Standards for Functions

8.F.A.1

Content Standards	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required in Grade 8.)
Explanations	Define, evaluate, and compare functions.
Content Limits	Function notation is not permitted Graphs should be discrete points and not continuous Distractors for Task Demand 3 should focus on misunderstandings of a function and not on incorrect computations
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify a function or a relation that is not a function, in table or graph form.	• Graphic Response • Multiple Choice Response • Matching Item Response • Table Response
Students will be required to create or complete a function or a relation that is not a function in table or graph form (item requires student to show both a function and a non-function).	
Students will be required to identify a graph of a function given a rule.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify a function rule that assigns to each input exactly one output. (Function notation is not required in Grade 8.)	Generate a function rule that assigns to each input exactly one output. Identify the graph of a function as the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required in Grade 8.)
Proficient	**Highly Proficient**
Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required in Grade 8.)	Explain that a function is a rule that assigns to each input exactly one output. Explain that the graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required in Grade 8.)

8.F.A.2

Content Standards	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*
Explanations	Define, evaluate, and compare functions.
Content Limits	Function notation is not permitted Only linear functions Only two functions Examples of properties are rate of change, starting point (y-intercept), and values at specific inputs
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify correct statement(s) comparing properties of two functions presented using different representations.	• Multiple Choice Response • Matching Item Response
Students will be required to identify a linear function that has certain properties when compared with a given function.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify properties of two functions each represented in the same way (algebraically, graphically, numerically in tables, or by verbal descriptions).	Compare properties of two functions each represented in the same way (algebraically, graphically, numerically in tables, or by verbal descriptions).
Proficient	**Highly Proficient**
Compare properties of two functions, each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.	Interpret properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

8.F.A.3

Content Standards	Interpret the equation y = mx + b as defining a linear function whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4), and (3,9) which are not on a straight line.*
Explanations	Define, evaluate, and compare functions.
Content Limits	Function notation is not permitted
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to categorize functions represented as equations or graphs as linear or nonlinear.	• Multiple Choice Response • Matching Item Response
Students will be required to categorize functions represented as tables as linear or nonlinear.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify a linear function whose graph is a straight line.	Interpret the equation $y = mx + b$ as defining a linear function whose graph is a straight line.
Proficient	**Highly Proficient**
Interpret the equation $y = mx + b$ as defining a linear function whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear, because its graph contains the points (1, 1), (2, 4), and (3, 9), which are not on a straight line.	Interpret the equation $y = mx + b$ as defining a linear function whose graph is a straight line; give real-world examples of functions that are not linear.

8.F.B.4

Content Standards	Given a description of a situation, generate a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or a graph. Track how the values of the two quantities change together. Interpret the rate of change and initial value of a linear function in terms of the situation it models, its graph, or its table of values.
Explanations	Use functions to model relationships between quantities.
Content Limits	Function notation is not permitted Limit to linear functions Given equations should always have just the dependent variable on one side of the equation.
Context	Context is subject to task demand.

Sample Task Demands	Common Item Formats
Students will be required to determine the rate of change and/or initial value of a linear function from an equation. Context is allowed.	• Equation Response • Graphic Response • Multiple Choice Response • Multi-Select Response • Proposition Response • Table Response
Students will be required to interpret the rate of change and initial value of a linear function in terms of its context. Context is required.	
Students will be required to create a linear equation by interpreting a table, a graph, a description, or two ordered pairs of the function. Context is allowed.	
Students will be required to determine the rate of change and/or initial value of a linear function from a table, a graph, a description, or two ordered pairs of the function. Context is allowed.	
Students will be required to create a linear equation, graph, or table that has a different rate of change and/or initial value when compared with a given function. Context is allowed.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Given a description of a situation, identify a function to model a linear relationship between two quantities.	Given a description of a situation, generate a function to model a linear relationship between two quantities. Identify the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or a graph.
Proficient	**Highly Proficient**
Given a description of a situation, generate a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or a graph. Track how the values of the two quantities change together. Interpret the rate of change and initial value of a linear function in terms of the situation it models, its graph, or its table of values.	Given a description of a situation, generate a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or a graph. Interpret how the values of the two quantities change together. Interpret the rate of change and initial value of a linear function in terms of the situation it models, its graph, or its table of values.

8.F.B.5

Content Standards	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
Explanations	Use functions to model relationships between quantities.
Content Limits	Linear and/or nonlinear relationships Graph descriptions traditionally move from left to right Graphs may or may not refer to quantitative measures as well as qualitative, i.e. the axes of graphs may or may not have scales Types of qualitative descriptions can include increasing/decreasing, linear/nonlinear, constant/variable, comparing rates (faster/slower), initial values that depend on the context and axes label, etc.
Context	Context is subject to task demand.

Sample Task Demands	**Common Item Formats**
Students will be required to identify a qualitative description given a graph, or a graph given a qualitative description, with no context. Context is not allowed.	• Graphic Response • Multiple Choice Response
Students will be required to identify a qualitative description given a graph, or a graph given a qualitative description, within a context. Context is allowed.	
Students will be required to construct the graph of a function that matches a given qualitative description. Context is required.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify a graph that exhibits the qualitative features of a function that has been described verbally.	Identify the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
Proficient	**Highly Proficient**
Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	Interpret the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Geometry

8.G.A.1

Content Standards	Verify experimentally the properties of rotations, reflections, and translations. Properties include: lines are taken to lines, line segments are taken to line segments of the same length, angles are taken to angles of the same measure, parallel lines are taken to parallel lines.
Explanations	Students need multiple opportunities to explore the transformation of figures so that they can appreciate that points stay the same distance apart and lines stay at the same angle after they have been rotated, reflected, and/or translated. Students are not expected to work formally with properties of dilations until high school.
Content Limits	The coordinate plane should not be used until 8.G.3. A pre-image and image should not include apostrophe-prime notation as this would give away the identification of similarity and congruence.
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify congruent properties based on a transformation(s).	• Equation Response • Multiple Choice Response • Multi-Select Response
Students will be required to solve a problem based on comparing part of a given shape to the corresponding part of its transformation.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify the properties of rotations, reflections, and translations. Properties include: lines are taken to lines, line segments are taken to line segments of the same length, angles are taken to angles of the same measure, parallel lines are taken to parallel lines.	identify experimentally the properties of rotations, reflections, and translations. Properties include: lines are taken to lines, line segments are taken to line segments of the same length, angles are taken to angles of the same measure, parallel lines are taken to parallel lines.
Proficient	**Highly Proficient**
Verify experimentally the properties of rotations, reflections, and translations. Properties include: lines are taken to lines, line segments are taken to line segments of the same length, angles are taken to angles of the same measure, parallel lines are taken to parallel lines.	Prove the properties of rotations, reflections, and translations. Properties include: lines are taken to lines, line segments are taken to line segments of the same length, angles are taken to angles of the same measure, parallel lines are taken to parallel lines.

8.G.A.2

Content Standards	Understand that a two-dimensional figure is congruent to another if one can be obtained from the other by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that demonstrates congruence.
Explanations	Understand congruence and similarity.
Content Limits	The coordinate plane should not be used until 8.G.3. Simply stating "dilation" is not sufficient for identifying a transformation that does not maintain congruence, since dilation by a factor of 1 does maintain congruence
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify a transformation or set of transformations that maintain congruence.	• Multiple Choice Response • Multi-Select Response • Proposition Response
Students will be required to describe a transformation given two congruent figures.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Given two congruent figures, identify a sequence that demonstrates congruence.	Understand that a two-dimensional figure is congruent to another if one can be obtained from the other by a sequence of rotations, reflections, and translations; given two congruent figures, identify a sequence that demonstrates congruence.
Proficient	**Highly Proficient**
Understand that a two-dimensional figure is congruent to another if one can be obtained from the other by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that demonstrates congruence.	Prove that a two-dimensional figure is congruent to another if one can be obtained from the other by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that demonstrates congruence.

8.G.A.3

Content Standards	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
Explanations	Dilation: A dilation is a transformation that moves each point along a ray emanating from a fixed center, and multiplies distances from the center by a common scale factor. In dilated figures, the dilated figure is similar to its pre-image. Translation: A translation is a transformation of an object that moves the object so that every point of the object moves in the same direction as well as the same distance. In a translation, the translated object is congruent to its pre-image. Reflection: A reflection is a transformation that flips an object across a line of reflection (in a coordinate grid the line of reflection may be the x or y axis). In a rotation, the rotated object is congruent to its pre-image. When an object is reflected across the y axis, the reflected x coordinate is the opposite of the pre-image x coordinate. Rotation: A rotated figure is a figure that has been turned about a fixed point. This is called the center of rotation. A figure can be rotated up to 360˚. Rotated figures are congruent to their pre-image figures.
Content Limits	Limit coordinates to integer values of x and y Limit rotations to about the origin Limit dilations to about the centers of shapes, or about the vertices of shapes When a coordinate grid is given, all original figures and transformations, given or not given, should fit onto that coordinate grid.
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify the coordinates of a figure after a given transformation.	• Equation Response • Graphic Response • Multiple Choice Response • Table Response
Students will be required to given a figure and transformation, draw the image or pre-image.	
Students will be required to identify the transformation that has occurred given an image and a pre-image or coordinates.	
Students will be required to given a point (x, y), use coordinate rules to show how that point changes after a transformation or transformations.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify the effect of dilations, translations, rotations, and reflections on two-dimensional figures.	Identify the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
Proficient	**Highly Proficient**
Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	Describe and interpret the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

8.G.A.4

Content Standards	Understand that a two-dimensional figure is similar to another if, and only if, one can be obtained from the other by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that demonstrates similarity.
Explanations	Understand congruence and similarity.
Content Limits	Items should not include the coordinate plane as the coordinate plane is needed in 8.G.3. Limited to polygons with up to 7 sides.
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to describe a transformation given two similar figures.	• Multiple Choice Response • Multi-Select Response

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Given two similar two-dimensional figures, identify a sequence that demonstrates similarity.	Understand that a two-dimensional figure is similar to another if, and only if, one can be obtained from the other by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, identify a sequence that demonstrates similarity.
Proficient	**Highly Proficient**
Understand that a two-dimensional figure is similar to another if, and only if, one can be obtained from the other by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that demonstrates similarity.	Explain that a two-dimensional figure is similar to another if, and only if, one can be obtained from the other by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that demonstrates similarity.

8.G.A.5

Content Standards	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*
Explanations	Students can informally prove relationships with transversals. Students can informally conclude that the sum of a triangle is 180o (the angle-sum theorem) by applying their understanding of lines and alternate interior angles.
Content Limits	Do not include shapes beyond triangles
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to use line-drawing tool to create angles of specified measure with respect to a given angle on a triangle.	• Equation Response • Graphic Response
Students will be required to use the AA criteria for similar triangles.	
Students will be required to create expressions that represent relationships between angles.	
Students will be required to drag/arrange text options to complete an argument/reasoning about angle measures of a triangle.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Use facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.	Identify facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.
Proficient	**Highly Proficient**
Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals explaining why this is so.	Prove arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.

8.G.B.6

Content Standards	Understand the Pythagorean Theorem and its converse.
Explanations	Students should verify, using a model, that the sum of the squares of the legs is equal to the square of the hypotenuse in a right triangle. Students should also understand that if the sum of the squares of the 2 smaller legs of a triangle is equal to the square of the third leg, then the triangle is a right triangle.
Content Limits	For the converse, use only perfect roots
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify components of a sufficient/insufficient proof of the Pythagorean theorem.	• Graphic Response • HotText Response • Multiple Choice Response • Multi-Select Response • Proposition Response
Students will be required to explain or evaluate a proof of the Pythagorean theorem.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify examples of the application of the converse of the Pythagorean Theorem.	Apply the converse of the Pythagorean Theorem.
Proficient	**Highly Proficient**
Understand the Pythagorean Theorem and its converse.	Prove the converse of the Pythagorean Theorem.

8.G.B.7

Content Standards	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world context and mathematical problems in two and three dimensions.
Explanations	Through authentic experiences and exploration, students should use the Pythagorean Theorem to solve problems. Problems can include working in both two and three dimensions. Students should be familiar with the common Pythagorean triplets.
Content Limits	Given measures should be integers, though answers can be rational
Context	Context is subject to task demand.

Sample Task Demands	Common Item Formats
Students will be required to find missing side lengths in a right triangle. Context is not allowed.	• Equation Response • Multiple Choice Response • Multi-Select Response
Students will be required to solve simple real-world problems using the Pythagorean theorem. Context is required.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Apply the Pythagorean Theorem to determine the hypotenuse in right triangles in real-world context and mathematical problems in two dimensions.	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world context and mathematical problems in two dimensions.
Proficient	**Highly Proficient**
Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world contexts and mathematical problems in two and three dimensions.	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world context and mathematical problems in two and three dimensions and interpret the results.

8.G.B.8

Content Standards	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
Explanations	Understand and apply the Pythagorean Theorem.
Content Limits	Points on the coordinate grid should be where grid lines intersect
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to determine the distance between two points on a coordinate grid.	• Equation Response • Graphic Response • Multiple Choice Response • Multi-Select Response

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Use the Pythagorean Theorem to find the distance between two points in the first quadrant of a coordinate system.	Use the Pythagorean Theorem to find the distance between two points in a coordinate system.
Proficient	**Highly Proficient**
Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	Apply the Pythagorean Theorem to find the scaled distance between two points in a coordinate system.

8.G.C.9

Content Standards	Understand and use formulas for volumes of cones, cylinders and spheres and use them to solve real-world context and mathematical problems.
Explanations	Solve real-world and mathematical problems involving volume of cylinders, cones and spheres.
Content Limits	Graphics of three-dimensional figures will be included in most items Dimensions are rational numbers Items should not require students to solve quadratic or cubic equations (i.e., find r given a volume) Rubrics should account for different estimations of pi (3.14, 22/7, the calculator button) if necessary
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to use formulas to determine the volume of a cylinder, cone, or sphere.	• Equation Response • Multiple Choice Response • Multi-Select Response
Students will be required to use formulas to determine the volume of composite objects composed of cylinders, cones, and/or spheres, or parts of these objects.	
Students will be required to compare the volumes/heights of cones and cylinders with the same base.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Apply formulas for volumes of cones, cylinders, and spheres.	Understand and use formulas for volumes of cones, cylinders, and spheres.
Proficient	**Highly Proficient**
Understand and use formulas for volumes of cones, cylinders, and spheres and use them to solve real-world context and mathematical problems.	Know and use formulas for volumes of cones, cylinders and spheres and use them to solve real-world context and mathematical problems.

Statistics and Probability & The Number System

8.NS.A.1

Content Standards	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion. Know that numbers whose decimal expansions do not terminate in zeros or in a repeating sequence of fixed digits are called irrational.
Explanations	Students can use graphic organizers to show the relationship between the subsets of the real number system.
Content Limits	All irrational numbers excluding e.
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify numbers that are irrational.	• Equation Response • Multiple Choice Response • Matching Item Response • Multi-Select Response • Proposition Response
Students will be required to convert a repeating decimal into a fraction.	
Students will be required to explain why a number is rational or irrational.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify irrational numbers.	Know that numbers that are not rational are called irrational. Identify a decimal expansion of irrational number.
Proficient	**Highly Proficient**
Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion. Know that numbers whose decimal expansions do not terminate in zeros or in a repeating sequence of fixed digits are called irrational.	Explain that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion. Explain that numbers whose decimal expansions do not terminate in zeros or in a repeating sequence of fixed digits are called irrational.

8.NS.A.2

Content Standards	Use rational approximations of irrational numbers to compare the size of irrational numbers. Locate them approximately on a number line diagram, and estimate their values.
Explanations	Students can approximate square roots by iterative processes.
Content Limits	All real numbers excluding e. Irrational expressions should only use one operation
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify the approximated value of an irrational number.	• Equation Response • Graphic Response • Multiple Choice Response • Multi-Select Response
Students will be required to estimate values of expressions that include irrational values.	
Students will be required to plot irrational numbers on a number line.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Approximate irrational numbers on a number line diagram.	Use rational approximations of irrational numbers to compare the size of irrational numbers. Locate them approximately on a number line diagram.
Proficient	**Highly Proficient**
Use rational approximations of irrational numbers to compare the size of irrational numbers. Locate them approximately on a number line diagram, and estimate their values.	Use rational approximations of irrational numbers to compare the size of irrational numbers. Locate them approximately on a number line diagram, and calculate their values.

8.NS.A.3

Content Standards	Understand that given any two distinct **rational** numbers, $a < b$, there exist a rational number c and an irrational number d such that $a < c < b$ and $a < d < b$. Given any two distinct **irrational** numbers, $a < b$, there exist a rational number c and an irrational number d such that $a < c < b$ and $a < d < b$.
Explanations	Understand that there are irrational numbers, and approximate them using rational numbers.
Content Limits	
Context	No Context

Sample Task Demands	**Common Item Formats**
Students will be required to recognize that there are rational and irrational numbers is between two rational or irrational numbers.	• Multiple Choice Response • Equation Response • Editing Task Choice
Students will be required to identify a rational or irrational number that has a value between two rational or irrational numbers.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Understand that given any two distinct rational numbers, $a < b$, identify a rational number c and an irrational number d such that $a < c < b$ and $a < d < b$.	Understand that given any two distinct rational numbers, $a < b$, identify a rational number c and an irrational number d such that $a < c < b$ and $a < d < b$. Given any two distinct irrational numbers, $a < b$, identify a rational number c and an irrational number d such that $a < c < b$ and $a < d < b$.
Proficient	**Highly Proficient**
Understand that given any two distinct rational numbers, $a < b$, there exist a rational number c and an irrational number d such that $a < c < b$ and $a < d < b$. Given any two distinct irrational numbers, $a < b$, there exists a rational number c and an irrational number d, such that $a < c < b$ and $a < d < b$.	Explain that given any two distinct rational numbers, $a < b$, there exist a rational number c and an irrational number d such that $a < c < b$ and $a < d < b$. Given any two distinct irrational numbers, $a < b$, there exist a rational number c and an irrational number d such that $a < c < b$ and $a < d < b$.

8.SP.A.1

Content Standards	Construct and interpret scatter plots for bivariate measurement data to investigate and describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
Explanations	Students build on their previous knowledge of scatter plots examine relationships between variables. They analyze scatterplots to determine positive and negative associations, the degree of association, and type of association. Students examine outliers to determine if data points are valid or represent a recording or measurement error.
Content Limits	Items at this standard should not require the student to perform calculations using values of data represented on a scatter plot. This will be reserved for High School statistics standards, when the appropriate technology is available. This standard should focus more on recognizing patterns of association.
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify patterns of association (clusters, outliers, positive/negative association, linear/nonlinear association) for a scatter plot.	• Graphic Response • Multiple Choice Response • Multi-Select Response
Students will be required to interpret patterns of association found in scatter plots in terms of a given context.	
Students will be required to construct a scatter plot using given data points and interpret patterns therein.	
Students will be required to construct scatter plots given a verbal description of the association.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Construct scatter plots for bivariate measurement data.	Construct scatter plots for bivariate measurement data to investigate and describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
Proficient	**Highly Proficient**
Construct and interpret scatter plots for bivariate measurement data to investigate and describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	Construct and interpret scatter plots for bivariate measurement data to investigate and interpret patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8.SP.A.2

Content Standards	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
Explanations	Investigate patterns of association in bivariate data.
Content Limits	Rational numbers, trend/association – not based on numbers, only based on visual strength, linear association only For items where student identify/construct a line of best fit, a correct line should not go through the origin - it is a common misconception that lines of best fit must go through the origin, so scatterplots should be given so that a line that goes through the origin is clearly incorrect. For items where the student judges the closeness of the data, the line of best fit should be correct for that data - the student is just judging how close those points are to the line.
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify an approximate line of best fit for a given scatter plot.	• Graphic Response • Multiple Choice Response • Multi-Select Response
Students will be required to construct an approximate line of best fit.	
Students will be required to compare the accuracy of a model by how closely the data follows the line of best fit for several models.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
For scatter plots that suggest a linear association, informally fit a straight line.	Identify straight lines used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
Proficient	**Highly Proficient**
Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

8.SP.A.3

Content Standards	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
Explanations	Investigate patterns of association in bivariate data.
Content Limits	Rational numbers Limit to linear equations Students should not be required to create an equation of a line of best fit; if a scatterplot/line of best fit is given, the parameter(s) of interest should also be given.
Context	Context is required.

Sample Task Demands	Common Item Formats
Students will be required to interpret the slope and intercept of a line of best fit, with slope and/or intercept parameter identified, in terms of the context.	• Equation Response • Multiple Choice Response • Multi-Select Response
Students will be required to interpret the slope and intercept of a modeling equation in terms of the context.	
Students will be required to solve problems about the slope and intercept of a line of best fit in terms of the context.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify properties of the equation of a linear model to solve problems in the context of bivariate measurement data.	Use the equation of a linear model to solve problems in the context of bivariate measurement data, identifying the slope and intercept.
Proficient	**Highly Proficient**
Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.	Create an equation for a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.

8.SP.A.4

Content Standards	Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.
Explanations	Investigate patterns of association in bivariate data.
Content Limits	Relate questions to grand total of survey Categorical variables Two columns (plus category and total) and two rows (plus category and total)
Context	Context is required.

Sample Task Demands	Common Item Formats
Students will be required to interpret and/or compare values in a two-way frequency table.	• Equation Response • Multiple Choice Response • Table Response
Students will be required to complete a two-way table based on given frequencies or relative frequencies.	
Students will be required to relate a two-way relative frequency table to whether there is an association between two variables.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Construct a two-way table summarizing data on two categorical variables collected from the same subjects.	Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects.
Proficient	**Highly Proficient**
Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.	Explain patterns of association seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

8.SP.B.5, 8.SP.B.5a, 8.SP.B.5b, 8.SP.B.5c

Content Standards	**8.SP.B.5** Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. **8.SP.B.5a** Understand that the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. **8.SP.B.5b** Represent sample spaces for compound events using organized lists, tables, tree diagrams and other methods. Identify the outcomes in the sample space which compose the event. **8.SP.B.5c** Design and use a simulation to generate frequencies for compound events.
Explanations	Investigate chance processes and develop, use, and evaluate probability models.
Content Limits	
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Identify the sample space for a compound event given an experimental design or a context.	• Equation Response • Multiple Choice Response • Table Response
Determine the probability of a compound event.	
Use simulations to determine the probability of compound events.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. a. Identify the probability of a compound event. b. Identify sample spaces for compound events using organized lists, tables, tree diagrams and other methods. c. Use a simulation to identify frequencies for compound events.	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. a. Identify the probability of a compound event as the fraction of outcomes in the sample space for which the compound event occurs. b. Represent sample spaces for compound events using organized lists, tables, tree diagrams, and other methods. c. Use a simulation to generate frequencies for compound events.
Proficient	**Highly Proficient**
Find probabilities of compound events using organized lists, tables, tree diagrams, and simulations. a. Understand that the probability of a compound event is the fraction of outcomes in the sample space in which the compound event occurs. b. Represent sample spaces for compound events using organized lists, tables, tree diagrams, and other methods. Identify the outcomes in the sample that composes the event. c. Design and use a simulation to generate frequencies for compound events.	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. a. Explain why the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. b. Represent sample spaces for compound events using organized lists, tables, tree diagrams, and other methods. Identify and interpret the outcomes in the sample space that composes the event. c. Design and use a simulation to generate frequencies for compound events and interpret in context.